

EVALUATING THE VAPOR INTRUSION TO INDOOR AIR PATHWAY

Primary Screening – Question #1

Q1: Are chemicals of sufficient volatility and toxicity (Table 1) known or reasonably suspected to be present in subsurface soils, soil gas, or ground water; the presence of these chemicals having resulted from releases subject to RCRA Corrective Action (e.g., from Solid Waste Management Units (SWMU), Regulated Units (RU), or Areas of Concern (AOC))?

 X If YES - check here, check the relevant chemicals on Table 1, and continue with Question 2 below;

 If NO - check here, provide rationale and references below, and skip to the Pathway-Specific EI Summary Page and document that the subsurface vapor to indoor air pathway is incomplete; or

 If sufficient data are not available, skip to the Pathway-Specific EI Summary Page and enter "IN" (more information needed) status code.

Criteria:

Table 1 provides a list of chemicals and indicates whether they are sufficiently volatile and toxic to pose an incremental lifetime cancer risk greater than 10^{-5} or a hazard index (HI) greater than 1, assuming continuous exposure to the maximum possible vapor concentration. This is an extremely conservative criterion, corresponding to an infinite supply of the pure chemical (e.g., NAPL pool), and no indoor air dilution, which is highly unlikely to occur. The exposure assumptions and calculations are documented in Appendix B.

Note: Table 1 may not include all possible chemicals of concern; it can be revised to include other chemicals according to the methods described in Appendix B, if the necessary chemical property and toxicity data is available.

Rationale and References:

Spray Products Corporation (Spray Products or facility) is a packager of aerosol products including paints, brake fluid, carburetor cleaners, starting fluid, and penetrants. Products are brought into the facility in bulk to be canned or packaged. Some of the organic solvents historically used at the property include, but were not limited to: 1,1,1-trichloroethane (TCA), tetrachloroethylene (PCE), trichloroethylene (TCE), acetone, toluene, methylene chloride, methyl isobutyl ketone (MIBK), methyl ethyl ketone (MEK), propylene glycol monomethyl ether acetate, and xylene.

Prior to 1986, in their packaging process, the facility generated dirty wash solvent from their clean-up operation. This dirty wash solvent was stored in drums for pick up in a tank wagon by a solvent reclaimer. The clean solvent was then recycled. The drums were staged in the drum storage area, which consisted of a concrete slab that had a small berm built by 1983 or 1984. The drum storage area was located outside in the southeastern portion of the property in the vicinity of the former underground storage tank (UST) farm. The UST farm was utilized for storage of product including diethyl ether, acetone, toluene, MIBK, and MEK. The USTs were removed in 1990, at which time, volatile organic compound (VOC) contamination was identified in soil and groundwater. Subsequent subsurface investigations suggested that the source of the contamination likely came from underground transfer piping.

In 1996, the facility began to lease the western portion of the property (west storage area) to a landscaping company for storing equipment and materials. Reportedly, no fertilizer or pesticide was kept at this location by the landscaping company. However, they maintained two 1,000-gallon aboveground storage tanks (ASTs) containing diesel fuel for refueling vehicles. The ASTs were reportedly situated on a concrete pad inside of secondary containment units. The landscaping company left the west storage area in 2004, dismantled their ASTs and took them with them. The facility representative stated he is not aware of any releases occurring from the ASTs. Only the concrete pad was present during the March 2012 site visit. There was no evidence of releases in the area at that time. Historically, the west storage area was used as a parking area for new car carrier operations formerly at the Norristown Wholesale property, and as a parking lot for towed vehicles (Weston, 2001). The west storage area is a large fenced and gated area that

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consists primarily of gravel, deteriorating asphalt and concrete pads, and scrub grass. The facility currently uses the west storage area for storage of empty drums and totes, trash bins, pallets, small out-of-service ASTs, storage trailers, etc. However, documentation (PADEP inspection reports) suggests that the facility stored approximately 360 drums of hazardous wastes in this area in 2007. Drums of soil from the heptane release that occurred in April 2011 were stored on wood pallets that were situated on the gravel/scrub grass in March 2012.

In 2012, the facility operates two business lines out of two separate buildings. The Spray Products line is a large scale operation in that production is no less than 25,000 units. This line operates out of the north building. The ORB line is a small scale version of the Spray Products line in that production can be from one can to 100 cans of aerosol. This line operates out of the south building. The buildings are separated by a fenced and gated yard through which is a rail spur. Raw materials are received by rail car, tanker, totes, 55-gallon drums, 30-gallon kegs, and 5-gallon pails. The materials are either stored in the rail car, in the bulk ASTs located in the tank farm, or in the drum storage area outside of the south wall of the north building. The rail cars are parked on the spur and the contents are pumped directly from the car.

Rail cars are switched out of the yard typically at a rate of one per day. Occasionally, up to three cars per day have been switched out of the yard. Based on aerial photographs, the spur was put in place when the facility was built. Previously, this area was open and vegetated. At times, tankers are temporarily stored on-site. At the time of the March 2012 site visit, a tanker containing dimethyl ether was staged on the soil/gravel area located directly west of the south building. The contents of the tanker were being pumped directly into the south building using flexible hoses.

The facility is an active large quantity generator (LQG) of hazardous waste (USEPA ID PAD042716084) generating the following five waste streams: (1) acetone wash; (2) waste heptanes; (3) waste methanol; (4) waste chloride that includes primarily methylene chloride but also contains PCE and TCE; and (5) insecticide. The facility maintains State Only Operating Permit (SOOP) No. 46-00139 for air emissions sources, which includes fugitive emissions from their 27 registered ASTs (Facility ID 46-15576). The facility also maintained a General Permit for Discharges of Stormwater from Industrial Activities (PAG-03) (No. PAR150007), which was not renewed when it expired in 2004. A renewal application for the PAG-03 permit prepared by Stantec Consulting Services, Inc. (Stantec) (Spray Products's consultant) is currently under review with facility management and will be submitted to PADEP.

The facility intends to obtain a PADEP Land Recycling Program (Act 2) release of liability for the contamination identified in soil and groundwater. However, the PADEP rejected the facility's Site Characterization Report submitted in 2003. In 2005, a Notice of Intent to Remediate was submitted to PADEP. The most recent documentation in the public files is from 2005, which includes additional groundwater monitoring data for the onsite monitoring wells. Per the PADEP Land Recycling Program website (accessed December 30, 2011), a Final Report and associated release of liability has not been issued for the facility. In 2012, Stantec completed an evaluation of the wells and have included in their work plan to the facility provisions to abandon several wells that were deemed beyond repair, and install three new wells. The work plan also provides for initiation of a sampling program. The facility stated that this work is on hold until the heptane release remediation work is completed due to budget restraints.

Site Layout

The facility is located at 1323 Conshohocken Road, Norristown, Montgomery County, Pennsylvania (Block 22, Lot 17). The facility is located in an industrial/commercial area; various industries are located in the immediate vicinity. Adjacent properties include an auto body shop to the north, a vacant lot to the east, Chemalloy (manufacturer of alloys, metals, minerals and chemicals for industrial applications) and a bulk oil terminal to the south, and a landscape contractor to the west across Conshohocken Road. Ivy Rock Clean Fill Reclamation (formerly Ivy Rock Quarry) is located approximately 2,200 feet southwest of the facility, west of Conshohocken Road. Residential areas are located less than a quarter mile to the north and the northeast. The facility lies east of Conshohocken Road, south of the Pennsylvania Turnpike (Interstate 276), north of a railroad line, and west of East Main Street. Diamond Run is located less than 0.25 miles to the northwest and the Schuylkill River is located less than 0.3 miles southwest of the facility.

The site covers 7.25 acres of land that contains two masonry and steel buildings (the north and south buildings) separated by the yard and the rail spur, an outdoor AST farm, and product storage areas.

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Access to the yard is limited by two locking gates located on each end of the yard. The north building contains offices, a cafeteria, a boiler room, warehouse space, a laboratory, a filling area, an in-line can popper and recycling process, a product batching area and an attached gas house. The south building contains a warehouse, packing and filling areas, a batching area, and an attached gas house. A can crusher was formerly located outside of the south building, but was recently removed.

In the north building, the batching area is used to store products and degreasers used for cleaning the paint line operation for the Spray Products line. It has a concrete floor, diking at the doorways, and no floor drains. At the time of the Preliminary Assessment (PA) completed by NUS Corporation (NUS) on behalf of the USEPA (1989), there were two product storage tanks in the central portion of the room; one contained a diesel fuel additive and the other was used storage of a penetrant (trade name: "Nuts-Off"). Another two-tiered storage tank area was also in the batching area, which contained four tanks of mineral spirits and 1,1,1-TCA (degreaser). During the March 2012 site visit, five batch mixing vessels, two 2,000-gallon ASTs containing PCE, and a satellite container (55-gallon drum) of waste heptane were present in the batching area.

The south building contains the batching, can filling, and packaging areas for the ORB line. This line consists of two process lines to fill aerosol cans with various products. The doorways had diking and the building had no floor drains. The packaging area contains a capping machine, a can labeling machine, and case packagers and sealers. Off-specification filled cans historically were taken to a can crusher located outside the packaging area's northwestern corner. The product drained into a recovery drum and was then repackaged. The crushed cans were placed into an adjacent trash dumpster. The can crusher was removed from service in 2009, removed from the facility's air permit in 2010 and was not present during the 2012 site visit. The paint batching area is located within the south building directly east of the filling area where paints are blended in vats. Batching was formerly conducted in a small shed situated between the south building and the AST farm. This shed is currently used for storage.

Ownership

According to the PA (1989), prior to 1961, the property was first utilized by the Penn Central Railroad as a rail yard. Ownership prior to Penn Central is unknown. The facility was then owned and operated by Strouse and Company from 1961 until 1973, when vandals started a fire on December 31, 1973. (The ruptured aerosol line was located in the Batching Area on-site.) Spray Products purchased the facility in 1974 (operations began on January 10, 1974) and operated it until 2001 when they sold the facility and name to ORB Acquisition Group, Inc. (ORB), the current owner. The facility operates under the name of Spray Products Corporation.

On December 27, 2001, ORB Industries, Inc., Bastian Enterprises, LLC, and ORB Acquisition Group, Inc. purchased the facility. The three companies maintain a Covenant Not to Sue from the PADEP, which was established in the April 24, 2002 Consent Order and Agreement (COA). ORB is the current owner and operator of Spray Products.

Bastian Enterprises originally owned ORB, which was located on 2 Race Street in Upland Borough. This facility operated under a separate USEPA identification number (PAD015056062) under the name of Spray Products, and was a small scale version of the Spray Products operation. Bastian Enterprises purchased Spray Products in 2002. In the summer of 2009, Bastian Enterprises closed the ORB facility in Upland and the company was absorbed into Spray Products. The materials and processes were moved to the 1323 Conshohocken Road facility. ORB's USEPA identification number for the Upland facility was reportedly terminated with the USEPA in 2009. The processes have not changed.

Waste Types and Quantities

On July 24, 1980, Spray Products Corporation submitted a Notification of Hazardous Waste Activity. On October 9, 1980 the USEPA acknowledged receipt of the notification form and issued the facility USEPA ID No. PAD042716084.

On March 4, 1983, PADEP submitted a formal request for the Part B of the Hazardous Waste Permit Application. On July 25, 1983, the facility determined that they would remove the storage facility; the Part B of the Hazardous Waste Permit was not necessary. On August 11, 1983, the facility was issued a notification as a Captive Generator – Large (PADEP eFACTS, 2011).

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Hazardous wastes generated at the subject property have included liquid wastes which were fuel blended by Safety-Kleen off-site. The waste is stored in drums, and staged within secondary containment within the diked portion of the AST farm or at the hazardous waste storage area. These storage areas were generally observed in good condition. No staining or cracks were observed. Clean products such as starting fluid are reclaimed on-site. Off-specification product is placed in the can crusher where the liquid in the can is collected in a 55-gallon drum for reuse. Paint products are not included in the recycling because of the many paint colors.

The July 24, 1980 Notification of Hazardous Waste Activity Form indicated that the facility generated paint and solvent cleaning waste (USEPA hazardous waste code K078) as well as D001 (ignitable) and D000 (non-specific toxic) wastes. The solvent waste consisted of wash solvent from clean-up operations. The facility's Part A Hazardous Waste Permit Application dated November 12, 1980 listed 10,000 gallons of container storage (S01) for the K078 waste, which was changed to D001 waste per letter dated July 21, 1981. Hazardous waste code K078 was suspended in July 1981 by the USEPA, and the material was thereafter designated as D001 waste.

On December 6, 1983, the facility submitted a notification of hazardous waste activity form to the PADEP changing the waste code for the wash solvent waste from D001 to U002 (acetone), since acetone was the largest single component of the waste (note that the form was dated 11-28-83). The facility also was seeking advice concerning how to classify their new wash solution, Cyclesolv 60, which was composed of 60 percent minimum blend of ketones and esters, 40 percent maximum blend of alcohols and aromatic hydrocarbons, and 5 percent maximum of chlorinated hydrocarbons. The facility recommended classifying the wash solution as D001, but requested PADEP to recommend a waste code designation.

The facility's Preparedness, Prevention, and Contingency (PPC) Plan dated February 1, 1984 listed the following waste types at the facility: paint manufacturing wastes (K087, which was suspended by USEPA), ignitable wastes (D001), and acetone (U001).

The 1986 Solid Waste Management Unit (SWMU) report listed the waste generated at the facility was paint solvent used for cleaning on the production line. The paint solvent consisted of the following:

Chemical	% By Volume	% by Weight
Propylene Glycol Monomethyl Ether Acetate *	5.1	5.6
Methyl Isobutyl Ketone	11.5	10.3
Acetone	51.3	45.7
Methylene chloride	14.0	20.7
Toluene	18.1	17.7
Total	100.0	100.0

* Changed from E.E. Acetate in early 1984

The facility was generating approximately 8,000 to 10,000 gallons (60,000 to 75,000 pounds) of this waste per year in 1986. The waste was stored in drums.

The 1992 Emergency Response Plan (ERP) submitted on January 16, 1992 indicated that flammable liquids were stored outside in bulk tanks in a diked area or in the hazardous material area, combustible liquids were stored in the mixing tanks or drums in the batch area, methylene chloride was in the bulk tank in the diked area, PCE and 1,1,1-TCA were in drums or tanks in the batch area, and isobutene and propane were in pressure vessels in the hazardous material area.

On March 8, 1993, the facility submitted a Notification of Regulated Waste Activity form listing F003 waste (non-halogenated solvents). It noted that they had not stored waste on the property since August 1983. The facility was a generator only.

In 2002, the facility stored off-specification material for some customers. This material was sent to the facility from these customers. The facility had asked the customers to remove the materials. The materials

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were finished products on pallets stacked in the north building.

A 2009 inspection noted sample waste types of flammable liquid (D001, F002, F003), waste methanol (U154, D001, F003), waste dichloromethane (F002), waste heptane (D001), and waste acetone (D001, F003).

In 2012, the facility generates five waste streams: (1) acetone wash; (2) waste heptanes; (3) waste methanol; (4) waste chloride that includes primarily methylene chloride but also contains PCE and TCE; and (5) insecticide. Acetone wash and waste heptanes are reportedly 95% of the waste generated at the facility. These wastes are sent to fuel blenders. The other wastes are sent to be incinerated. All wastes are containerized in 55-gallon drums and stored in the outdoor bermed hazardous waste storage area on the west end of southern building. The wastes are handled by Nexeo. During the March 2012 site visit, 22 drums of waste were present in the storage area that included 3 drums of acetone; 7 drums of waste heptanes; 9 drums of waste methanol; 2 drums of dichloroethylene; and 1 drum of insecticide. There was 1 drum of oil dry material outside of the containment area. One drum of waste heptane was observed in the batching area satellite storage area in the north building and one drum of waste heptane was stored in the satellite storage area within the AST containment area.

Nonhazardous solid waste (general refuse), including paper, food, plastics, glass, crushed metal cans, and cardboard generated at the facility is collected and disposed of off-site through a commercial vendor, BFI, approximately once a week. Cardboard is also recycled.

The former landscaping operation used materials to service their vehicles, including oils, greases, etc. These materials appeared to be in the manufacturers' containers that were generally less than 5 gallons (Weston, 2001). No pesticides or fertilizers were stored on-site. No hazardous waste was generated at the former landscaping operations.

SWMUs

The 1989 PA identified the following three SWMUs (SWMUs 1 through 3) that are located within a fenced in portion of the facility. During the March 2012, one additional SWMU (SWMU 4) was identified.

SWMU 1 - Former Hazardous Waste Drum Storage Area (Former UST Farm): This 35 by 65 foot concrete pad was located outside in the southeastern portion of the facility within the UST tank farm and product storage area. The pad and a portion of the concrete dike (6-inch high; 8 by 25 feet) remained at the time of the 1989 PA. The pad was being used for storage of empty drums and drums of product. There were no known releases from this SWMU that began operations in 1975; the last shipment was on October 30, 1986 (SWMU inactive since this shipment). Wastes were stored in sealed, 55-gallon drums and included spent wash solvents containing toluene, methylene chloride, acetone, MIBK, and propylene glycol monomethyl ether acetate, and were classified as ignitable (D001). Secondary containment around this area was built sometime around 1983 or 1984, according to a November 28, 1983 response to a compliance inspection. In 1989, no evidence of spills was observed. Per the PPC plan, rainwater accumulated within the SWMU was collected and stored in drums prior to disposal. On August 1, 1989, the facility representative indicated to NUS that the closure of the drum storage pad was held up until the USTs beneath the pad were removed; this action was planned for Spring 1990. Also, the facility reused the solvent from cleaning operations in primers where colors were unimportant thereby eliminating a waste stream.

Based on the description of work completed by CM Environmental Services (CMES) in May 1990 for the UST closures, the concrete storage pad associated with the drum storage area and underlying soils would have been removed concurrent with the tank work. Soil boring investigations were subsequently conducted by HSI in 2002 at various potential areas of concern (AOCs) associated with waste storage (e.g., can crusher, empty product drum storage). The findings associated with this work were reportedly submitted to PADEP, but the facility's current consultant (Stantec) did not locate any regulatory correspondence in the facility's files specifically confirming PADEP approval for the AOC closures. The exact location of this former SWMU is uncertain; however, the suspected location of the former hazardous waste drum storage area was concrete covered and in good condition during the 2012 site visit.

SWMU 2 – Former Off-Specification Can Crushing Machine/Dumpster Area: Historically, the can crusher was located outside the northwestern corner of the packaging area (the northwestern corner of the south building). In this SWMU, cans were crushed using a worm auger to puncture filled off-specification cans.

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Product drained into a recovery drum and was then repackaged (reclaimed). The crushed cans were placed into an adjacent trash dumpster. There were no known releases reported by the facility from this SWMU that was installed in 1987. Wastes managed at the unit included starting fluids (containing ether), brake and carburetor cleaners, and penetrants (containing phenols, oils and solvents) (D001). The unit and associated dumpster used to store the crushed cans were located on the concrete driveway. In 1989, no evidence of spills was observed by NUS.

A July 10, 2007 PADEP inspection identified a clear, odorless liquid coming out of the ground between the can crusher and the gate and running into a storm drain. PADEP requested that measures be taken to keep the unknown material out of the storm drain. In March 2012, the facility representative reported that he has no knowledge of the alleged leak from the can crusher and that the can crusher was taken out of service in 2009 and was removed from the facility's air permit in 2010.

Currently, the cans are punctured in-line at the beginning of the fill station in the north building. The solvent is recycled directly back into the filling process, and the cans are scrapped. The concrete surface in the area where the can crusher was formerly located appeared to be in good condition with minor staining observed.

SWMU 3 – Former Empty Product Drum Storage Area (Former and Current Hazardous and Raw Materials Storage Area): During the NUS site visit in 1989, empty product drums that contained penetrants, paints, and brake fluids (D001) and drummed product were stacked upright on pallets and stored outside the southern side of the north building. Empty drums were also stored in the tank farm and product storage area. There were no known releases from this SWMU that began operation in 1975. In 1989, no evidence of spills was observed.

Historically, this area has been used to store hazardous materials. As observed during the 2012 site visit, the area is used for storage of various quantities and types of raw materials that are stored in drums and totes. The drums and totes are stored on pallets, stacked two to three high. The pallets are situated on the concrete and asphalt surface. There are no other containment features. The asphalt surfaces are in fair to poor condition; however, no evidence of release was observed. Steel plates had been placed over portions of the asphalt that had been damaged. Totes are also stored across the yard on the concrete surface between the tank farm and the south building. There are no other containment features. The concrete was in good condition at the time of the 2012 site visit. No evidence of releases was observed.

SWMU 4 – Hazardous Waste Storage Area: This storage area was observed outside the northwestern corner of the concrete block south building during the March 2012 site visit. The storage area consists of a concrete floor surrounded by a concrete berm (1 foot high). The northern section of the berm was removed to allow for forklift traffic. A temporary rubber berm was present that is used to close the open section in the concrete berm. The storage area looks to be as wide as a loading dock bay door [located adjacent a former loading dock and bay door] and approximately 15 feet long. During the March 2012 site visit, 22 drums of waste were present in the storage area that included 3 drums of acetone; 7 drums of waste heptanes; 9 drums of waste methanol; 2 drums of dichloroethylene; and 1 drum of insecticide. There was 1 drum of oil dry material outside of the containment area. The drums were labeled with hazardous waste labels. Outside the diked area was a pallet with an opened drum that contained oil dry from a recent hydraulic oil release from a Norfolk Southern engine (see AOCs section).

AOCs

The Additional Site Characterization Study (ERI, 1995) identified areas of concern, which were located in the back southeast corner of the property. The AOCs included the old copper pipe area, former UST excavation area, and the rail spur. See *Investigations and Remedial Actions to Date* section for historic investigation information.

The Site Characterization Report for Soil and Groundwater (HSI, 2002) identified seven potential areas of concern (PAOCs). The PAOCs included:

- PAOC 1 – Former Copper Product Lines
- PAOC 2 – Vapor Flux Area Between Buildings (Freon 12)
- PAOC 3 – Vapor Flux Area North of Warehouse (DCA and Freon 12)
- PAOC 4 – Former Drain Line Beneath Warehouse

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- PAOC 5 – Can Crusher/Dumpster Area (SWMU 2)
- PAOC 6 – Empty Product Drum Storage Area (SWMU 3)
- PAOC 7 – Western Parcel - B&M Landscaping

Ruptured Aerosol Line Release: A ruptured aerosol line in the batching area that led underground to the filling area ruptured during a 1973 fire that may have released materials to subsurface soils (NUS, 1989). The facility representative interviewed during the 2012 site visit has only been with the company for 10 years. He stated that there are no employees remaining from the original Spray Products work force; therefore, the location of the possible release is unknown.

Heptane Spill: On April 26, 2011, PADEP conducted a spill investigation after the facility discovered on April 25, 2011 (April 22, 2011) that an employee failed to close an opened valve on the heptane AST (AST 024A). Approximately 4,000 gallons were released into the south building and spilled outside onto a concrete-covered rail spur that had cracks. See *Investigations and Remedial Actions to Date* section for investigation information.

Diesel Spill: On June 1, 2011, a PADEP Incident Notification form was completed following a 200-gallon diesel spill to soil. A tractor trailer owned by Joint Express, Inc. drove off the edge of the facility's parking lot into a grass-covered area. When the wheels of the truck sank into the soil, the trailer tipped over, and one of its fuel tanks was punctured on an inactive light stanchion. See *Investigations and Remedial Actions to Date* section for investigation information.

Norfolk Southern Release: During the March 2012 site visit, a relatively recent release of hydraulic oil from a Norfolk Southern engine was observed along the railroad spur leading into the facility yard from the west. The release was a trail that extended approximately 200 feet, and ending approximately 50 feet inside of the yard. The impacted areas consisted of gravel, asphalt, and grass-covered surfaces. The facility had spread oil dry over portions of the release that occurred on the asphalt surfaces immediately outside and within the yard (the facility's property). Some of the oil dry had been cleaned up, drummed, and stored adjacent to the hazardous waste storage area. However, the portion of the spill that had occurred on the gravel outside of the facility was not addressed. The facility representative stated that he was contacting Norfolk Southern to clean this area up because the release occurred from their engine on their property and the facility was not responsible.

Storage Tanks

In 1989, to the east of the south building was the tank farm and product storage area. The tank farm consisted of various used and unused ASTs and 10 USTs. The used tanks contained either ether or heptanes. All of the ASTs were located over dirt and gravel; however, six of the ASTs were surrounded by a 1.5-foot high concrete dike. In 2012, there are no longer any known USTs onsite.

USTs

UST Assessment Following the Removal of 10 USTs (1990): As reported in the letter report of July 11, 1990 by CMES, on May 9 and 10, 1990, 10 steel USTs in the chemical UST farm were removed by C. Delong Associates with oversight by CMES. The 10 USTs were located adjacent to each other with six USTs in line to the south of 4 in line USTs. The pertinent UST information is summarized in the following table.

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USTs			
ID	Size	Contents	Status
1	6,000	Diethyl Ether	Removed 1990 intact
2	6,000	Diethyl Ether	Removed 1990 intact
3	6,000	Diethyl Ether	Removed 1990 intact
4	6,000	Diethyl Ether	Removed 1990 intact
5	6,000	Diethyl Ether	Removed 1990 intact
6	6,000	Diethyl Ether	Removed 1990 intact
7	6,000	Diethyl Ether	Removed 1990 intact
8	3,000	Diethyl Ether	Removed 1990 intact
9	6,000	Acetone, Toluene, MIBK, MEK	Removed 1990 intact
10	3,000	Acetone, Toluene, MIBK, MEK	Removed 1990 intact

The USTs were emptied prior to removal. After removal, the USTs were cleaned, cut up and disposed offsite. On May 9, 1990, C. Delong Associates Inc. collected soil samples and on May 10, 1990, CMES collected soil and water samples from beneath the USTs.

The size of the excavation was approximately 60 feet long by 36 feet wide by 12 feet deep. The excavation began approximately 10 feet south of the rail spur and extended south 36 feet. The length of the excavation parallel to the rail spur was 60 feet and the total depth varied from 10 to 13 feet. Groundwater was observed in the bottom of the northern half of the excavation and in the southwestern corner of the excavation. A concrete pad on the ground surface above the USTs was broken into pieces and stockpiled beside the excavation for offsite disposal. Any pieces with observable stains were cleaned on-site before disposal. The screenings that surrounded the USTs initially remained in the excavation until analytical work was performed. The screenings revealed petroleum and solvent odors and a sheen was observed on top of the groundwater in the excavation.

After the USTs were removed, CMES conducted a visual examination and found no observable holes or signs of staining or leakage on the sides, tops, and bottoms of the USTs.

A total of eight soil samples were collected by CMES beneath USTs 7, 8, 9 and 10 (Soil Samples 5, 6, 7, 8, 9, 10, 11, and 12). One sample was collected beneath both ends of each UST. Two groundwater samples were collected below two of the USTs (i.e. one beneath UST 7 [Water Sample 2] and one beneath UST 9 [Water Sample 3]). Three soil samples were collected from the virgin soil at an approximate depth of 11 feet (i.e. Samples 1D, 2D, and 3D). Sample 1D was taken from the center of the northern half of the excavation, Sample 2D from the southwestern corner of the excavation, and Sample 3D from the southeastern corner of the excavation. The soil and groundwater samples were analyzed for total petroleum hydrocarbons (TPH); benzene, toluene, ethylbenzene, and total xylenes (BTEX), MIBK, MEK, acetone, methylene chloride, heptane, and diethyl ether.

On May 10, 1990, CMES notified PADEP that during the excavation of the USTs, there was product visible in the excavation on either the shallow groundwater table or the perched groundwater table.

Several VOCs were detected in each of the soil samples of the material directly below the USTs. Higher VOCs were detected below USTs 7, 8, 9, and 10, which were removed from the northern half of the excavation. The highest total VOCs were detected in Soil Sample 9 and Soil Sample 12 having total VOCs of 393,600 micrograms per kilogram (ug/kg) and 285,700 ug/kg, respectively. Diethyl ether was detected in 10 soil samples, with the highest concentration being 44,000 ug/kg. Acetone was detected (estimated) in every sample with the highest concentration being 16,000 B ug/kg. MIBK was detected in one sample at 1,500 J ug/kg. MEK was detected in one sample at 2,100 ug/kg. VOCs were detected in each of the three groundwater samples from the excavation. The highest concentration of total VOCs was detected at 843,900 micrograms per liter (ug/L) in Water Sample 3, which was collected from below UST 9. Diethyl ether (highest concentration of 330,000 ug/L) and acetone (highest concentration of 400,000 ug/L) were detected in the three groundwater samples. MIBK was not detected in any samples. MEK (22,000 ug/L)

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was detected one sample.

TPH were detected in all 15 soil samples and all three groundwater samples. A PADEP regulatory guideline for TPH in soil of less than 100 milligrams per kilogram (mg/kg) was exceeded in twelve of the soil samples collected. Higher TPH concentrations were detected in Soil Samples 2D, 6, and 3D at 370 mg/kg, 355 mg/kg, and 329 mg/kg, respectively. The PADEP regulatory limit of 1 mg/L for TPH in groundwater was exceeded in all three groundwater samples. The highest concentration of TPH was detected in Water Sample 3 at 800 mg/L.

As contamination was detected, PADEP approved excavating to bedrock, installing three monitoring wells in the excavation, then backfilling the excavation. The southeastern corner of the property was cleared of vegetation to provide an area to stockpile the contaminated soil. Plastic was placed below and on top of the stockpile. (Note: According to the Final Report for Soil Pile Remediation and Closure prepared by United States Environmental Services Corp. [USES], dated September 9, 1994, the excavated soil was stockpiled in the area directly west of the south building between the railroad tracks and the rail spur.)

In addition, visually contaminated groundwater was pumped from the bottom of the excavation into drums. Sorbent pads were also placed on top of the groundwater in the excavation to absorb the oily sheen.

After excavating, bedrock was reached on June 5, 6, and 8, 1990. CMES collected new soil samples and a groundwater sample from the bottom of the excavation. The excavation was divided into six areas and a two-point composite soil sample was collected from each area (i.e. Samples S-1 PSE, S-2 PSE, S-3 PSE, S-4 PSE, S-5 PSE, S-9 PSE, and S-10 PSE). A groundwater sample was collected from the center of the southern half of the excavation. Samples were analyzed for TPH and BTEX (plus library search). (Note: MIBK and MEK, and other VOCs, do not appear to have been analyzed.)

Concentrations of VOCs detected were drastically reduced. The highest concentration of total VOCs in soil was 368 ug/kg. No diethyl ether was detected in the soil samples; acetone was detected in six samples, ranging from 25 JB to 35,000 JB ug/kg. TPH in soil ranged from 31.6 mg/kg to 368 mg/kg. Other constituents detected in the soil samples included methylene chloride, toluene, xylenes, 3-methyl hexane, 2,3-dimethyl pentane, 2-methyl hexane, and ethylbenzene (all constituents detected previously).

Diethyl ether was detected in the groundwater sample at 10,000 ug/L; acetone was detected at 5,800 B ug/L. TPH in groundwater was 51.8 mg/L. Other constituents detected in the groundwater sample included methylene chloride, toluene, 3-methyl hexane, 2-methyl hexane, 4-methyl-2-pentanone (MIBK).

Three monitoring/recovery wells were installed in the excavation. One well was set in the northeast corner of the excavation, one in the northwest corner of the excavation, and one along the south-center of the excavation. The wells were 15 feet deep and were constructed of 10 feet of 4-inch diameter, .020 slotted PVC, and five feet of solid PVC riser. The space around the wells was backfilled with sand to two feet above the slotted PVC screen and a sand/cement slurry was used to fill the annulus to grade. A protective steel casing was placed over each well. CMES recommended two rounds of sampling of these wells be conducted during the upcoming six months.

2,000-Gallon UST: In January 2008, while installing a new scale in the south building, a manhole was discovered. When opened, a 2,000-gallon UST was found that contained 98 percent water. The facility representative stated that the UST was identified on a 1961 Plumbing Storage and Filling Building Plan. The contents were unknown, but it appeared that the floor drains that were formerly in the building discharged to that UST. During the March 2012 site visit, the facility representative stated the floor drains were plugged with concrete long before he began working there. Prior to closure of the UST, the facility collected a sample of the UST contents (water/residual liquid) for laboratory analysis for waste characterization purposes. The analytical results as reported by Rinco Analytical Services for a sample of the clear liquid collected from the UST on June 19, 2007, indicated that ignitability was greater than 212 degrees Fahrenheit; pH was 6.9; there were no toxicity characteristic leaching procedure (TCLP) metals, VOCs (limited list), or semivolatile organic compounds (SVOCs) (limited list); and there were no sulfides. The analytical results indicated that the liquid was not RCRA hazardous. The contents of the UST (2,081 gallons described as an oil/water mix) were removed using a vacuum truck and transported for treatment/disposal to Environmental Recovery Corporation, Inc. (ERC) on January 23, 2008 by Elk

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Environmental, Inc. Following emptying of the UST, the UST was closed-in-place by Elk Environmental using flowable fill. The integrity of this UST is unknown and no investigation of this UST and surrounding soils has occurred (Weston, 2001).

ASTs

After the USTs were removed and the excavation backfilled, a concrete pad was poured over the former location and the new ASTs were installed. The registered and unregistered ASTs identified at the facility are presented in the following table.

ASTs					
IDs PADEP (Plant)	Size	Contents	Location	Status	Secondary Containment
001A (01)	5,000	Isopropyl Alcohol	Area 1	Active	Yes
002A (02)	5,000	De-icer	Area 1	Active	Yes
003A (03)	5,000	Heptane	Area 1	Active	Yes
004A (04)	5,000	Heptane	Area 1	Active	Yes
005A (05,15)	10,000	Acetone	Area 1	Active	Yes
012A	1,000	Mineral Seal Oil	Inside north building	Removed	N/A
013A	1,000	Mineral Seal Oil	Inside north building	Removed	N/A
014A	1,000	Mineral Seal Oil	Inside north building	Removed	N/A
015A	1,000	Empty (formerly Mineral Seal Oil)	Area 1	Out of Service since approximately 2006	Yes
016A	2,000	Perchloroethylene	Inside north building filling area	Active	Yes
017A	2,000	Perchloroethylene	Inside north building filling area	Active	Yes
018A (18, 701)	6,000	Chemical Blend	Area 1	Active	Yes
019A (19, 702)	6,000	Chemical Blend	Area 1	Active	Yes
020A (703)	6,000	Chemical Blend	Inside north building batch area	Active	Yes
021A (704)	6,000	Chemical Blend	Inside north building batch area	Active	Yes
022A (706)	7,500	Diethylether	Area 1	Active	Yes
023A (707)	7,500	Diethylether	Area 1	Active	Yes
024A (24,705)	10,000	Heptane	Area 1	Active	Yes
025A (25)	6,000	Diethylether	Area 1	Active	Yes
026A (26)	6,000	Diethylether	Area 1	Active	Yes
028A	8,000	Chemical Blend	Area 1	Active	Yes
029A	8,000	Chemical Blend	Area 1	Active	Yes

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030A	8,000	Chemical Blend	Area 1	Active	Yes
031A	6,000	IPA (currently Hexane)	Area 4	Active: Installed 6-4-08	Yes
032A (31)	6,000	Hexane (currently D-95 solvent)	Area 4	Active: Installed 6-4-08	Yes
033A (34)	6,000	Xylene (currently Toluene)	Area 4	Active: Installed 6-4-08	Yes
034A	6,000	Lubricating Oil Solvent (currently Xylenes)	Area 4	Active: Installed 6-4-08	Yes
(152A)		1,1-Difluoroethane	Area 3	Active	No
(108A)		Aeron	Area 3	Active	No
unnumbered		Aeron/NP-70	Area 3	Active	No
(134A)		1,1,1,2-Tetrafluoroethane	Area 3	Active	No
	8,000	Fuel Oil	Fuel Oil Tank	Active	Yes

Per the March 2012 site visit, the ASTs are used for raw materials storage. No waste is stored in the ASTs. To best identify the location of the tanks, the tank areas have been identified as Areas 1 through 4.

Area 1 – Area 1 is the large containment structure located at the former UST tank farm. The area consists of poured concrete floors and walls. Some of the piping is within the containment; some piping runs are over soil/grass. The ASTs are raised within the containment structure. During the March 2012 site visit, liquid was observed in the containment areas. The facility representative stated that he periodically calls Elk Environmental to pump out the fluids. Elk samples the fluids prior to vacuuming them out and transporting them offsite for disposal. The containment area was in good condition with no significant staining. Tank vessels (rail cars) were present on the track immediately north of the AST area. The rail cars were parked immediately north of the railroad tracks.

Area 2 – Area 2 is located west of Area 1. Area 2 stores the 26,000 ton carbon dioxide (CO₂) cryogenic tank and many totes stored on asphalt with no secondary containment. Piping behind this area was over soil/long grass. The piping was rusted.

Area 3 – Area 3 is east of Area 1. ASTs 108A, 134A, 154A, and an unnumbered AST in the area are situated over gravel with concrete walkways around the ASTs. AST 134A is situated over concrete with no other secondary containment. There was no staining observed beneath or in the area of these four ASTs. Formerly, there were three propane ASTs located in this area (WES, 1989).

Area 4 – Area 4 contains the four vertical ASTs located adjacent to the batching area of the northern building. The ASTs are raised above the concrete base and walls of the containment structure.

Fuel Oil AST – The diked, 8,000-gallon fuel oil tank is located north of the south building. The diked AST is situated on soil/gravel and grass. Prior to 1990, when this new AST was installed, an 8,000-gallon UST was located in its location. The former UST was connected to the boiler room by underground piping. When the UST was removed, it reportedly had no holes and the soil around the UST did not have any odors or traces of oil (C. DeLong Associates, Inc.).

In 2002, there were 12 process tanks in the mixing area. These tanks were:

- Five 1,000-gallon, stainless steel
- Three 500-gallon, jacketed
- One 5,100-gallon, stainless steel
- One 2,000-gallon, stainless steel
- Two 1,500-gallon, black iron

During the 2012 site visit, five stainless steel process tanks were observed in the filling area of the north building, and six were located inside of the batching area of the south building. These tanks are on wheels

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and can be easily moved throughout the facility. The tanks were situated on the concrete floor. No secondary containment units were present.

On January 30, 1992, the facility notified PADEP of the inventory of chemicals stored at the facility. It noted that although the facility is not located next to the Schuylkill River, they were required to notify all facilities with intakes located within 20 miles downstream of the facility. Chemicals included acetone (3,000 to 8,000 gallons), ethyl ether (10,000 to 40,000 gallons), heptanes (10,000 to 20,000 gallons), hexane (500 to 7,500 gallons), methanol (0 to 5,000 gallons), methylene chloride (500 to 4,000 gallons), mineral spirits (500 to 2,000 gallons), toluene (1,000 to 3,000 gallons), 1,1,1-trichloroethane (500 to 2,000 gallons), and No. 2 fuel oil (1,000 to 8,000 gallons). The largest tank was 10,000 gallons and the facility has a maximum capacity of 110,000 gallons.

eFACTS identifies 20 ASTs (Tanks 001A, 002A, 003A, 004A, 005A, 012A, 013A, 014A, 015A, 016A, 017A, 018A, 019A, 020A, 021A, 022A, 023A, 024A, 025A, and 026A) registered to ORB on April 30, 2002. On December 27, 2004 the list of registered ASTs was modified by ORB to include 028A, 029A and 030A.

On June 18, 2008, JD Environmental Inc. on behalf of ORB sent the Storage Tank Registration Permitting Application to PADEP for a series of four 6,000-gallon single-walled steel ASTs (031A, 032A, 033A, 034A) containing isopropyl alcohol, hexane, xylene, and lubricating oil solvent, respectively, at the Spray Products facility. The tanks were provided with secondary containment.

On March 19, 2010, PADEP requested a Spill Prevention Response Plan (SPRP) for facilities exceeding storage capacities exceeding 21,000 gallons. Per the facility representative, the last revision to the SPRP was done in 2005 when it was prepared by Gilmore and Associates.

On November 30, 2010, Mott Tank Inspection Inc. sent AST inspection summaries for ASTs 005A (15), 025A (rear), 026A (front), 018A (701), 019A (702), 020A (703), 021A (704), 022A (706), 023A (707), and 024A (705).

On December 6, 2010, PADEP sent a Notice of Violation (NOV) following an October 7, 2010 inspection when an integrity in-service inspection was conducted on tanks 025A and 026A and identified that both tanks lacked emergency vents and that the shells, nozzles, and roofs had coating deterioration and were in unsatisfactory condition. PADEP requested the deficiencies be corrected with 60 days. During the March 2012 site visit, the facility stated they had no knowledge of the NOV, and would not have knowingly not responded to it. On July 16, 2012, the PADEP Storage Tanks Program provided a copy of the 2010 NOV to the facility. As of July 20, 2012, the facility was preparing a response to the NOV. Per the March 2012 site visit, the facility is currently cleaning and painting the ASTs as well as making any repairs as needed (i.e., replacing seals, upgrading venting).

The facility's air emissions sources are permitted under SOOP 46-00139 which includes VOC emissions from the propellant gasser/product filling lines and fugitive emissions from the storage tanks. The facility is surrounded by industrial and commercial properties including an auto body shop, a former quarry (now clean fill landfill), a manufacturer of alloys, metals, minerals, and chemicals for industrial uses, a bulk oil terminal, and a landscaping company. The facility buildings are slab-on-grade construction. Floor drains were present inside of the buildings that have been sealed. Underground wastewater lines were also present beneath the buildings.

Soil vapor samples were collected using Petrex tubes from a depth of 18 inches throughout the site during ERI's 1995 investigation. VOCs and SVOCs, lighter-phase petroleum hydrocarbons (gasoline), and heavier-phase hydrocarbons (oil) were identified on-site. No source areas for gasoline or oil range petroleum hydrocarbon compounds were known to exist onsite. Toluene was observed at significant concentrations in on-site groundwater, but reported soil vapor fluxes for BTEX did not correlate with background monitoring well analytical data. The highest vapor flux areas for PCE, chlorobenzene/dichlorobenzene, DCA, and Freon 12 were situated between the north and south buildings directly north of the AST farm/former UST excavation area. Additional areas of high vapor flux for DCA and Freon 12 were located directly north of the north building in the area of MW-8S, centrally located between the buildings, and south of the southwest end of the south building (Freon 12). High vapor flux areas for TCE were observed directly west of MW-4S/4D and directly northeast of MW-2S/2D.

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The results for the Petrex tube samples only provide a relative vapor flux. The results are not a measure of the concentration of specific compounds; therefore, no direct comparison to regulatory criteria can be made. VOCs have been detected in soils and groundwater beneath the property. VOCs in groundwater continue to be detected in the shallow and deeper fractured bedrock aquifers above the PADEP residential and non-residential MSCs, and have been shown to be migrating offsite to the northwest and southwest. A source area has not been identified. All soil investigation work has been conducted outside of the buildings. There has been no sub-slab investigation work completed at this time.

The facility is a packager of aerosol products. Daily operations utilize solvents. According to the facility representative, employee air monitoring is conducted on a quarterly basis. This will continue indefinitely, but is now being handled by a consulting firm. Therefore, no additional exposure controls appear to be warranted at this time. High concentrations of VOCs were detected in groundwater at the facility's property boundaries. The vertical and horizontal extent of the VOC-impacted groundwater migrating offsite has not been fully characterized. Therefore, it is unknown whether offsite structures may be impacted such that exposure controls would be required.

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Primary Screening – Question #2

Q2: Are inhabited buildings located near subsurface contaminants having sufficient volatility and toxicity?

_____ If YES - check here, identify buildings below, and continue with Question 3 below.

_____ If NO – check here and skip to the Pathway-Specific EI Summary Page and document that the subsurface vapor to indoor air pathway is incomplete, or

 X If sufficient data are not available - check here and skip to Pathway-Specific EI Summary Page and enter “IN” (more information needed) status code.

Criteria:

The goal of this question is to identify buildings that could potentially have a complete pathway, i.e., indoor air concentrations above levels that would pose a lifetime incremental cancer risk of 10^{-5} , or a hazard index of >1 . For the purposes of this question:

- “**inhabited buildings**” are structures with enclosed air space that are designed for human occupancy.
- “**subsurface contaminants having sufficient volatility and toxicity**” are defined by Table 1 and were discussed above in Question 1.
- An inhabited building is considered “**near**” subsurface contaminants if it is located within 100 ft laterally of known or interpolated soil gas or groundwater concentrations in excess of the criteria in Table 2.

A distance criterion is necessary to focus the assessment on buildings most likely to have a complete pathway. Vapor concentrations generally decrease with increasing distance away from a subsurface vapor source, and at some distance, the concentrations become negligible. The distance at which concentrations are negligible is a function of the mobility, toxicity and persistence of the chemical, as well as the geometry of the source, subsurface materials, and characteristics of the building of concern. Definitive studies on this topic have yet to be conducted, but 100 feet is a reasonable criterion when considering vapor migration fundamentals, typical sampling density, and uncertainty in defining the actual contaminant spatial distribution.

Identify Inhabited Buildings Within Distances of Possible Concern:

High concentrations of VOCs were detected in groundwater at the facility’s property boundaries. The vertical and horizontal extent of the VOC-impacted groundwater migrating offsite has not been fully characterized. Therefore, it is unknown whether offsite structures may be impacted such that exposure controls would be required.

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Primary Screening Stage— Question #3

Q3. Is **immediate action warranted** to mitigate current risks to residents of those buildings identified in Question 2 to be located within the area of concern?

_____ If YES – check here and proceed with immediate actions to verify or eliminate imminent risks, which may include indoor air quality monitoring, engineered containment or ventilation systems, or relocation of receptors¹. The immediate action(s) should be appropriate for the situation.

_____ If NO – check here and then continue with Question 4 below.

Criteria:

Here we focus on those buildings identified in Question 2 to be located within the areas of concern. The following qualitative criteria are considered sufficient to justify immediate actions:

Odors reported by occupants, particularly if described as “chemical”, or “solvent”, or “gasoline”. The presence of odors does not necessarily correspond to adverse health and/or safety impacts and the odors could be the result of indoor vapor sources; however, it is prudent to investigate any reports of odors as the odor threshold for some chemicals exceeds their respective acceptable target breathing zone concentrations.

Physiological effects reported by occupants (dizziness, nausea, vomiting, confusion, etc.).

Wet basements, in areas where chemicals of sufficient volatility and toxicity (see Table 1) are known to be present in groundwater and the water table is shallow enough that the basements are prone to groundwater intrusion or flooding, especially if there is evidence of light, non-aqueous phase liquids (LNAPLs) floating on the water table directly below the building, and/or any direct evidence of contamination (liquid chemical or dissolved in water) inside the building.

Short-term safety concerns are known, or are reasonably suspected to exist - for example: a) explosive or acutely toxic concentrations of vapors have been measured in the building or connected utility conduits; b) explosive or acutely toxic levels of vapors are likely to be present in utility conduits, sumps, or other subsurface drains directly connected to the building. Lower explosive limits are typically in the range of 1 to 5% by volume (10,000,000 ppbv to 50,000,000 ppbv).

There may be circumstances in which the Responsible Party elects to initiate indoor air quality monitoring and/or proactively eliminate exposures through avoidance or mechanical systems, rather than pursue continued assessment of the pathway. In some cases this may be a cost-effective option as it leads directly to an incomplete subsurface vapor to indoor air pathway. This option is available at any time in the assessment. Furthermore, some buildings are positively pressurized as an inherent design of the heating, ventilating and air conditioning system, and it may be possible to show that the pathway is incomplete by demonstrating a significant pressure differential from the building to the subsurface. Proactive indoor air quality monitoring may also be initiated at any time, although it is not necessary if the pathway can be confirmed to be incomplete using other data.

Rationale and Reference(s):

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Q4: Do measured or reasonably estimated indoor air, soil gas, or ground water concentrations² exceed the target media-specific concentrations given in Table 2?

_____ If NO, and there is no reason to believe that the conservative attenuation factor of 0.01 is inappropriate—document representative media concentrations on Table 2 and check here. Go to the Pathway-Specific EI Summary Page and document that the subsurface vapor to indoor air pathway is incomplete.

_____ If YES – check here. If indoor air concentrations are known and these are greater than the target indoor air concentrations, then the pathway is complete and engineering controls or avoidance measures need to be implemented. If only soil gas or groundwater data are available, and these exceed the target criteria, document representative media concentrations on Table 2 and then proceed to Question 5.

_____ If sufficient data are not available - check here and skip to Pathway-Specific EI Summary Page and enter “IN” (more information needed) status code.

Criteria:

Question 4 is intended to allow a rapid screening of available site data, which may include soil gas, groundwater, or indoor air concentrations. Concentrations in the three media are assumed to be correlated, so that data from any of the three media can be used. If data are available for more than one media, all of the data should be considered in answering Question 4. As discussed in Appendix A, confidence in the assessment increases with multiple lines of evidence, so additional data may be collected for consideration in Question 4, at the discretion of either the responsible party or the lead regulatory authority, to the extent that this may be necessary and appropriate.

Note that it is important to segregate the buildings of interest into two categories: a) buildings lying above areas where contaminated groundwater is the only source of contaminant vapors, and b) buildings lying above areas where contaminated vadose (unsaturated) zone vapor sources are present. While indoor air quality data can be used to judge the pathway completeness in either case, the appropriate use of groundwater and soil gas data is different for these two cases. In case (a) either the soil gas or groundwater criteria in Table 2 can be used at this step, while in case (b) only soil gas criteria and soil gas samples collected above the vapor source zone can be used. This is because the groundwater criteria have been derived assuming no other vapor sources between the water table and the building foundation. This also applies for Question 5.

The term “measured or reasonably estimated” is used above (and throughout this document) as it is recognized that measurements at all buildings of concern may not be practical or necessary. For example, groundwater concentrations beneath buildings are commonly estimated from concentrations collected in wells distributed about a larger area of interest. Likewise, one might reasonably estimate upper bound indoor air concentrations for a group of buildings based on the measurements taken from those buildings expected to have the highest concentrations.

In the case of soil gas concentrations, measured or reasonably estimated soil gas concentrations at any depth in the subsurface may be used in Question 4, provided that this depth falls below the foundation depth. As there are concerns about the integrity of shallow soil gas samples, it is recommended that samples collected at depths <5 ft below ground surface (BGS) not be used for this analysis, unless they are collected immediately below the building foundation several feet in from the edge. Samples from fixed probes are also preferable, but not required. With respect to the spatial distribution of sampling points, close proximity to the building(s) of concern is preferred; however, it may be possible to reasonably estimate concentrations based on data from soil gas samples collected about a larger area. Users should also consider that, in general, samples collected at depth closer to the vapor source are much less likely to be dependent on the surface cover (i.e. pavement, lawn, foundation) than shallow soil gas samples.

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In the case of groundwater concentrations, these should be measured or reasonably estimated using samples collected from wells screened at, or across the top of the water table. This is necessary to be consistent with the derivation of the target groundwater criteria in Table 2. Samples from groundwater monitoring wells may be a blend of groundwater from different levels across the screened interval. Confidence in the results can be increased through use of a more narrowly screened interval across the water table, or a variety of other depth-discrete sampling protocols. These issues, and others to be considered during data collection, are discussed in Appendix A.

Question 4 calls for comparison with the target criteria given in Table 2; however, this guidance is not intended to supersede existing state-specific guidance or regulations. Thus, the lead regulatory agency will determine the appropriate criteria to be used here and in Questions 5 and 6. If target criteria are not available, then the tables provided with this guidance should be used. A regulatory agency may have already developed acceptable indoor air concentrations, but they might not have derived vapor intrusion pathway-specific target media concentrations. In this case, the methods discussed in Appendix B can still be used to derive target soil gas and dissolved groundwater concentrations consistent with those existing target indoor air concentrations. Where pathway-specific media concentrations already exist, the values provided in this guidance should be considered national benchmarks, and the governing regulatory authority should compare the methods and assumptions used to derive their criteria with the methods used in this guidance. In any case, users of this guidance should review the methods used to derive the tables presented in this guidance, and consider whether or not the assumptions and methods are appropriate for their application. These assumptions are discussed briefly below, and in more detail in Appendix B.

The target media-specific concentrations given in Table 2 correspond to indoor air concentrations calculated to cause an incremental lifetime cancer risk of 10^{-5} or a Hazard Index of 1.0 (whichever is more restrictive). In the case of the soil gas criteria, a conservative soil gas to indoor air attenuation factor of 0.01 is used. For the groundwater criteria, there is an additional conservative assumption that the partitioning of chemicals between groundwater and soil vapor is assumed to obey Henry's Law. Table 2 may not include all possible chemicals of concern; it can be revised to include other chemicals of concern according to the methods described in Appendix B, if chemical property and toxicity data is available.

The soil gas to indoor air attenuation factor represents the ratio of the indoor air concentration to the soil gas concentration at some depth. The 0.01 value is considered to be a reasonable upper-bound value for the case where the soil gas concentration immediately beneath a foundation is used (e.g., the indoor air concentration would not be expected to exceed 1/100 of the concentration immediately below the foundation). This value is based on available data from sites where paired indoor air and soil gas samples immediately below a foundation were available, and also theoretical considerations. It is a conservative enough criterion that it should be protective even in settings where the building has significant openings to the subsurface. In addition, since it has been argued that the 0.01 value is conservative for deriving near foundation soil gas criteria, the soil gas criteria derived using this value would be even more conservative if applied to soil gas concentrations measured or reasonably estimated at any other deeper depth. For reference, attenuation factors as low as 0.00001 have been determined from data at some sites. There may be some settings where the 0.01 attenuation factor is not a conservative upper-bound value; however, most of these settings would presumably be identified and addressed in Question #3.

The authors of this guidance felt that the uncertainties associated with soil partitioning calculations as well as the uncertainties associated with soil sampling and soil chemical analyses (see EPA/600/SR-93/140) were so great that use of soil concentrations for assessment of this pathway is not technically defensible. Thus, soil concentration criteria were not derived and the use of soil criteria is not encouraged. However, as discussed above, this guidance is not intended to supersede existing State guidance, and users should follow the appropriate guidance as determined by the lead regulatory authority. Furthermore, proponents may elect to defend the use of soil concentration data in the Site-Specific Pathway Assessment, Question 6.

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The soil gas and groundwater target concentrations were derived from the target indoor air criteria, without consideration of ambient outdoor air quality or other chemical sources internal to the building. The target concentrations should therefore be interpreted as target incremental concentrations above background levels. To be consistent with that definition, background concentrations should be subtracted from measured or reasonably estimated indoor air concentrations before comparison against the Table 2 (or other appropriate) criteria.

Values appearing in Table 2 were derived for an incremental lifetime cancer risk (R) of 1×10^{-5} and hazard index (HI) of 1. The risk-manager or decision-maker should consider a number of variables when comparing site data to the Table 2 criteria, including: the number and locations of samples, the spatial and temporal variability of concentrations, the frequencies of exceedances of Table 2 criteria, the magnitude of exceedances of Table 2 criteria, and the degree of conservatism built into Table 2 values. The Table 2 criteria are not intended for use as "bright-line criteria", below which any measured or reasonably estimated concentrations are acceptable and above which any concentrations are unacceptable. Instead, professional judgment should be used when applying the criteria. For example, if eight out of ten samples satisfy Table 2 criteria and the other two exceed the criteria, but only by a factor of two or three, the risk-manager might decide that the pathway is incomplete, even though two of the samples exceed the criteria. This is because the risk estimate is still in the same order-of-magnitude as the target risk level and there is some conservatism built into the Table 2 values.

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Secondary Screening – Question #5

Q5: Using the appropriate scenario-specific attenuation factor (from Figure 1), do measured or reasonably estimated soil gas or ground water concentrations exceed the target media-specific concentrations given in Table 3?

_____ If NO, and there is no reason to believe that the scenario-specific attenuation factor is inappropriate, check here and document the Rationale and References for the scenario-specific attenuation coefficient below. Go to the Pathway-Specific EI Summary Page and document that the subsurface vapor to indoor air pathway is incomplete.

_____ If YES – check here, and if representative measured or reasonably estimated soil gas and/or groundwater concentrations are considerably (i.e. greater than 100 times) higher than the values in Table 3 then interim exposure controls and/or measurement of indoor air quality monitoring should be conducted as soon as practicable; and when representative media concentrations are less than 100 times the appropriate Table 3 values proceed to further analysis and modeling in Question 6.

_____ If sufficient data are not available - check here and skip to Pathway-Specific EI Summary Page and enter "IN" (more information needed) status code.

Criteria:

Soil gas or groundwater to indoor air attenuation factors are expected to depend on building characteristics, chemical type, soil type, and depth of the source (which is defined as either a measured soil gas concentration at the specified sample collection depth below the building, or the ground water concentration at the depth of the water table). The 0.01 attenuation factor value used in Question 4 is representative of expected upper bound values for vapors located immediately below the building, and therefore does not depend on soil type or depth. Question 5 considers the site-specific soil type and depth of source to allow for a more representative vapor attenuation factor, and consequently the target media concentrations. The target indoor air concentrations remain the same (unchanged from Table 2), but target soil gas and groundwater concentrations will vary with changes in the vapor attenuation factor.

Attenuation factors have been calculated for some combinations of source depth, soil type, and building characteristics using the Johnson and Ettinger (1991) model. Reasonable building characteristics were selected and held constant in these calculations and the chemicals were assumed not to degrade. To capture the effect of changes in soil properties, the U.S. Soil Conservation Service (SCS) soil texture classifications were considered, and a subset of these were selected. This subset was chosen so that their relevant properties (porosity and moisture content) would collectively span the range of conditions most commonly encountered in the field. Then, plots of attenuation factor vs. depth were calculated and these results are presented below in Graphs 1a (for use of soil gas data) and 1b (for use of groundwater data). The two graphs are different because the first does not have to account for transport across the capillary fringe.

Details of these calculations are included in Appendix B. The depth used should be: a) the vertical separation between the soil gas sampling point and the building foundation for use of Graph 1a, or b) the vertical separation between groundwater and the building foundation for use of Graph 1b. Samples collected near to, but at depths shallower than the building foundation should not be used. Table 4 should be used to help select the most appropriate soil texture classification as discussed below.

The site characterization should include collection of soil samples at various depths between the building foundation elevation and contamination source (i.e., vertical soil gas and/or groundwater quality profiling) and description of soil lithology. The preferred method for determining the SCS soil class is to use lithological information combined with the results of grain size distribution tests on selected soil samples. Procedures for conducting grain size distribution tests are provided in American Society for Testing and Materials (ASTM) Standard Test Method for Particle Size Analysis of Soils (D422-63) and U.S. Natural Resources Conservation (NRCC) Soil Survey Laboratory Methods Manual, Soil Survey Laboratory Investigations Report No. 42.

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The U.S. SCS soil texture classes are based on the proportionate distribution of sand, silt and clay sized particles in soil. It does not include any organic matter. The grain size boundaries are as follows:

Sand: 0.05 mm to 2 mm
Silt: 0.002 mm to 0.05 mm
Clay: <0.002 mm

The soil textural classes are displayed in the SCS soil textural triangle. The soil texture class is determined by plotting the grain size distribution results on the soil texture triangle. If a soil texture class is not intersected based on the five classes included in the guidance, the nearest soil class is chosen. The selection of the soil texture class should be biased towards the coarsest soil type of significance, as determined by the site characterization program.

There are sites where different soil classifications systems have been used, and where information on soil lithology and grain size distribution is limited. Most engineering soil classification systems are either based on grain size, or a combination of grain size and engineering properties (e.g., Unified Soil Classification System (USCS), ASTM D2488-84, NAVFAC DM7.2 (1982)). For several soil classification systems, soil is divided into a coarse-grained fraction consisting of sand and gravel (or larger) particles (greater than 0.075 mm size) and fine-grained fraction consisting of silt and clay (less than 0.075 mm size). Soils are characterized as fine-grained if more than 50 percent is less than 0.075 mm in size. Various descriptors of particle size proportions such as trace, few, little, some, or use of the grain size class as an adjective or noun are often used to describe different soil types. In some cases engineering properties are also used to determine the appropriate soil type description. Unfortunately, there are widespread differences in both the soil classification systems used to describe soils and differences in the quality of lithological descriptions incorporated in boring logs. To assist users of guidance in cases where lithological and grain size information is limited, Table 4 below provides guidance that can be used to select, in appropriate terms, the appropriate soil texture class.

Table 4. Guidance for selection of soil type curves in Graphs 1a and 1b.

If your boring log indicates that the following materials are the predominant soil types . . .	then you should use the following texture classification when obtaining the attenuation factor
Sand or Gravel or Sand and Gravel , with less than about 12% fines, where "fines" are smaller than 0.075 mm in size.	Sand
Sand or Silty Sand , with about 12% to 25% fines	Loamy Sand
Silty Sand, with about 20% to 50% fines	Sandy Loam
Silt and Sand or Silty Sand or Clayey, Silty Sand or Sandy Silt or Clayey Sandy Silt, with about 45 to 75% fines	Loam
Sandy Silt or Silt, with about 50 to 85% fines	Silt Loam

We note that there is no soil texture class represented as consisting primarily of clay. Exclusion of clay was deliberate since homogenous, unfractured clay deposits are rare. Users of this guidance have the option to refine selection of soil properties as part of the Site Specific Pathway Assessment.

The user must defend their scenario choice with site-specific data. Given the approximate nature of this approach, users should round their attenuation factor to the nearest half order-of-magnitude (0.01, 0.003, 0.001, 0.0003, or 0.0001), selecting the higher number if the best estimate is between two increments. Then, the columns in Table 3 can be used to determine the appropriate target media concentrations. Values in Table 3 were derived as discussed in Appendix B.

Interim exposure controls and/or measurement of indoor air quality should be conducted as soon as practicable if measured or reasonably estimated soil gas and/or groundwater concentrations are considerably (i.e. greater than 100 times) higher than the values in Table 3 since the Site-Specific Assessment step is very unlikely to result in an attenuation factor that is 100 times smaller than the attenuation factor determined at this stage. This is especially true for any chemical (degradable or not) when shallow (e.g., <2 ft beneath the building foundation) soil gas concentrations are being used for assessment.

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If the media concentrations being used are from a significant depth and the chemicals of concern are known to degrade aerobically, it is possible for the actual attenuation factor to be considerably less than the value determined in this step. However, this issue should be addressed through vertical soil gas profile sampling involving shallower samples in this question (or other direct empirical evidence and supporting data to show the profile of oxygen, carbon dioxide, or other indicators of microbial activity are adequate to validate conceptual models based on analogous case studies in similar settings, in Question 6). Again, if shallow soil gas samples are being used, it is unlikely that degradation will contribute significantly to increased attenuation between the sampling point and the building.

It should also be recognized that it may be less expensive (or more desirable for other reasons) to install and operate exposure controls than to conduct further assessment. This guidance neither requires nor precludes such an approach, and it is left to the discretion of the responsible party to decide if proactive exposure controls are cost-effective.

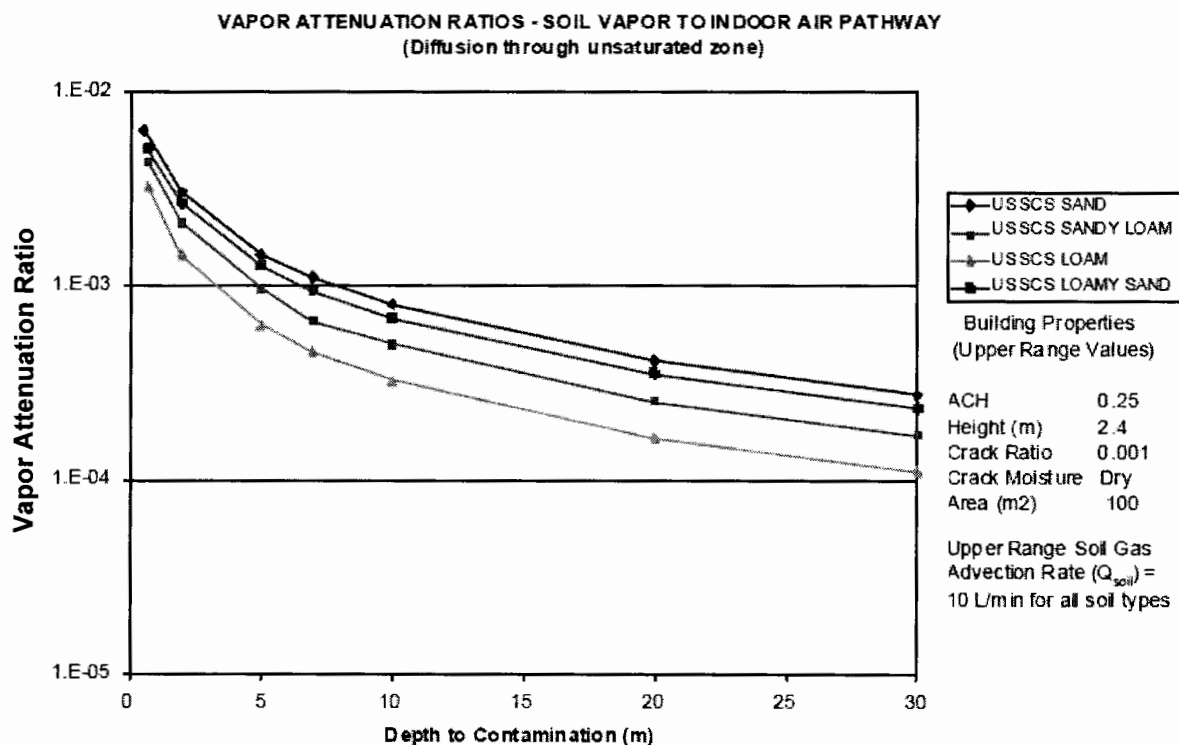


FIGURE 1

Graph 1a. For use with soil gas monitoring data.

(future edits to add: units of feet, ½ order-of-magnitude lines, and clarify y-axis is "Vapor Attenuation Ratio")

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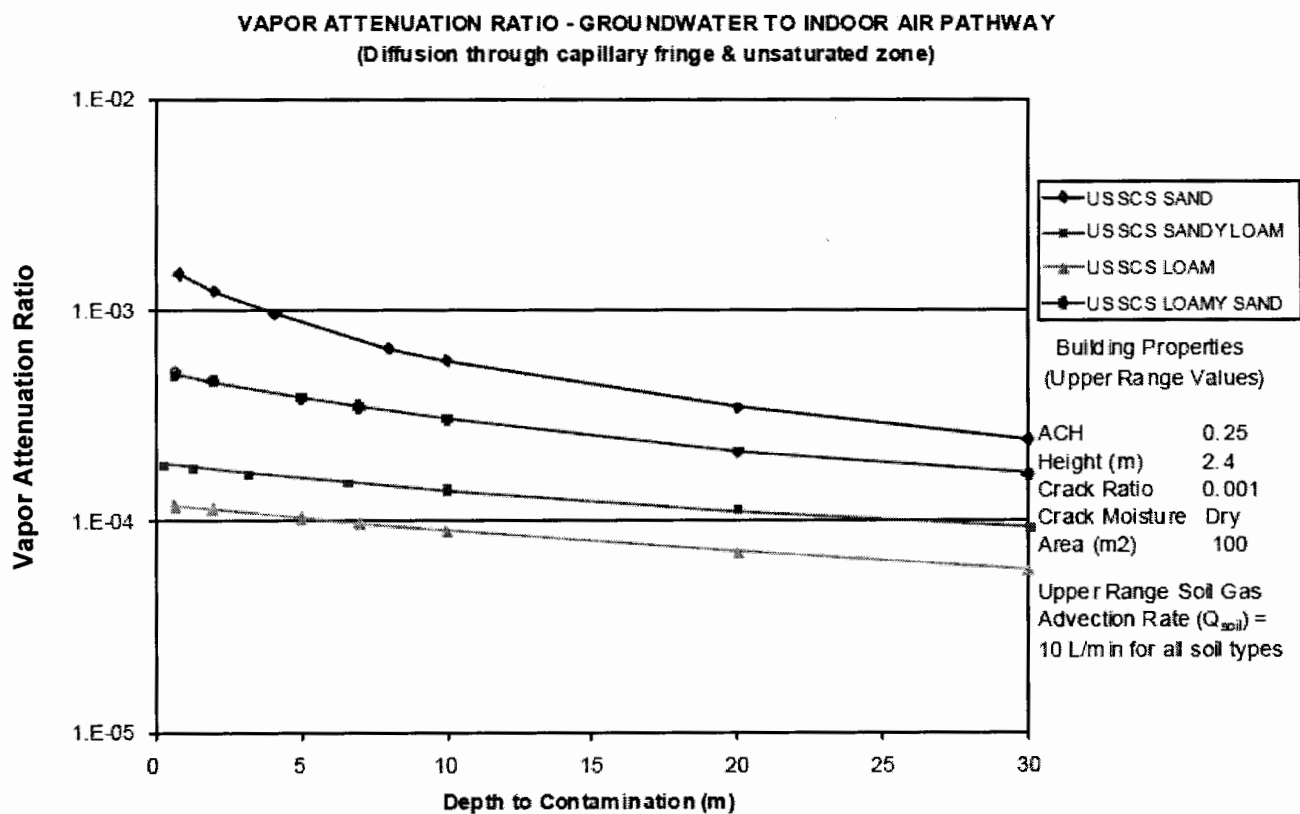


FIGURE 2

Graph 1b. For use with groundwater monitoring data.

(future edits to add: units of feet, ½ order-of-magnitude lines, and clarify y-axis is "Vapor Attenuation Ratio")

Rationale for Selecting Site-Specific Attenuation Factor and Reference(s):

EVALUATING THE VAPOR INTRUSION TO INDOOR AIR PATHWAY

Site-Specific Assessment – Question 6

Q6: Do measured or reasonably estimated soil gas or ground water concentrations exceed media-specific criteria developed specifically for this site?

_____ If YES - check here and implement exposure controls (avoidance or mechanical systems with appropriate monitoring to demonstrate their effectiveness) to prevent possible human exposures to subsurface vapors migrating into indoor air. Prepare a performance monitoring plan and proceed to Question 7;

_____ If NO – check here and provide documentation of Site-Specific Assessment for regulatory review.

_____ If sufficient data are not available - check here and skip to Pathway-Specific EI Summary Page and enter “IN” (more information needed) status code.

Criteria:

The Site-Specific Pathway Assessment is intended to be used where site-specific conditions warrant further consideration prior to concluding either that the pathway is incomplete, or that some form of exposure control is required. The assessment could be as simple as using the same equations employed to develop the Secondary Screening criteria but with revised inputs that are defended with site-specific data. It could also be as complex as a comprehensive mapping of subsurface vapor distributions and measurement of subsurface material properties affecting gas flow and transport, combined with the development of a site-specific vapor transport model. The data needs are greater here than in the Primary and Secondary Screening; however, the necessary data might already be available from previous site characterization work. A conceptual model of the site and subsurface vapor transport and vapor intrusion mechanisms will be needed to defend the Site-Specific Pathway Assessment. Model inputs and assumptions that are different than the generic assumptions in Questions 4 and 5 criteria (and others to be added to the appendices) must be supported with site-specific data.

The site-specific conceptual model should be developed in the source-pathway-receptor framework, and it should identify how the site-specific conceptual model is similar to, and different from, the generic conceptual model used in developing Table 3. Key components of the conceptual model may need to be justified with site-specific data, including, but not limited to the source (chemical constituents, concentrations, mass, phase distribution, depth, and aerial extent), pathway (soil texture, moisture, and layering) and receptor (building design, construction, and ventilation). The indoor air concentrations may be simulated with a mathematical model, which the user must be prepared to document and defend as appropriate for the site-specific conceptual model. The user must also defend model inputs (different than those (to be added to) the appendices) by validated site-specific data. The discussion above in Appendix A concerning data sufficiency is also applicable here. Indoor air quality sampling and analysis is neither required, nor precluded; however, if indirect data (e.g. soil gas data) are to be used exclusive of indoor air quality data, the vapor attenuation factor must be assigned either using site-specific data (e.g. the building ventilation rate, pressure differentials, soil gas permeability), or using conservative assumptions. If the pathway is not judged to be incomplete during the Primary, Secondary, or Site-Specific Screening, it is considered to be complete, unless some action is taken. Possible actions include:

- engineered containment systems (subslab de-pressurization, soil vacuum extraction, vapor barriers)
- ventilation systems (building pressurization, indoor air purifiers)
- avoidance (temporary or permanent receptor relocation) or
- removal actions to reduce the mass and concentrations of subsurface chemicals to acceptable levels
- (i.e., remediation efforts).

Rationale and Reference(s):

EVALUATING THE VAPOR INTRUSION TO INDOOR AIR PATHWAY

Post-Assessment Monitoring – Question 7

Q7: Will temporal monitoring data or performance monitoring data (for a mechanical exposure control system) be collected to assess whether the pathway remains incomplete?

_____ If YES - check here and provide a brief summary of the monitoring requirements, or reference monitoring work plan.

_____ If NO – check here and provide justification.

Criteria:

Performance Monitoring is necessary to ensure that the pathway remains incomplete for sites relying on exposure control systems. **Pathway Monitoring** is recommended for sites where the measured or reasonably estimated media concentrations are at, or marginally less than the target media concentrations for that site, or when temporal trends cannot be reasonably predicted with existing data. This could involve repeated sampling of groundwater, soil gas, or indoor air on some appropriate frequency. The need for pathway monitoring is decided by the lead regulatory authority; however, one should consider the derivation of the target media concentrations and differences between those and measured or reasonably estimated values when determining monitoring requirements. Presumably, monitoring is less important in cases where measured or reasonably estimated media concentrations are an order of magnitude less than the more conservative media criteria (Table 2), and monitoring is more important when measured or reasonably estimated media concentrations are only marginally less than criteria selected at Question 5 (Table 3) or Question 6. As additional data becomes available, it should be compared with previous data as well as the target media-specific concentrations. If exceedances occur, or are projected to occur, appropriate actions (usually engineering controls) should be taken, or continued. If monitoring demonstrates that the pathway is incomplete and will remain so under current site conditions, then other actions are not necessary.

Rationale and Reference(s):

EVALUATING THE VAPOR INTRUSION TO INDOOR AIR PATHWAY

Pathway-Specific EI Summary Page

Facility Name: Spray Products Corporation

Facility Address: 1323 Conshohocken Road, Norristown, Pennsylvania 19401

Facility EPA ID #: PAD042716084

Below, check the appropriate status codes for the Subsurface Vapor to Indoor Air Pathway evaluation on the EI determination and attach appropriate supporting documentation as well as a map of the facility.

Is there a Complete Pathway for subsurface vapor intrusion to indoor air?

 NO – the "Subsurface Vapor Intrusion to Indoor Air Pathway" has been verified to be incomplete, based on review of the information contained in this EI Determination of the **Spray Products Corporation, 1323** facility, EPA ID # **PAD042716084** , **Conshohocken Road, Norristown, Pennsylvania** **19401**

 based on performance monitoring evaluations for engineered exposure controls. This determination will be re-evaluated when the Agency/State becomes aware of any significant changes at the facility.

 YE – Yes, The "Subsurface Vapor to Indoor Air Pathway" is Complete.

 X IN – More information is needed to make a determination.

Locations where References may be found.

USEPA Region III	PADEP
Waste and Chemical Mgmt.	South East Regional Office
Division	2 East Main Street
1650 Arch Street	Norristown, PA 19401
Philadelphia, PA 19103	

Contact telephone and e-mail numbers:

(name) Camelia Draghiciu

(phone #) 484.250.5743


(e-mail) cdraghiciu@pa.gov

This document is dedicated to the late Craig Mann, who was a member of the authoring committee, a prominent researcher in the field and programmer of the widely-used spreadsheet version of the Johnson and Ettinger (1991) model available at www.epa.gov/superfund/programs/risk/airmodel/johnson_ettinger.htm. He was a friend and inspiration to us all.

FINAL NOTE: THE HUMAN EXPOSURES EI IS A QUALITATIVE SCREENING OF EXPOSURES AND THE DETERMINATIONS WITHIN THIS DOCUMENT SHOULD NOT BE USED AS THE SOLE BASIS FOR RESTRICTING THE SCOPE OF MORE DETAILED (E.G., SITE-SPECIFIC) ASSESSMENTS OF RISK.

RCRA Land Revitalization Indicators

Status of Use & Type of Use

 EPA	United States ENVIRONMENTAL PROTECTION AGENCY Region III, Philadelphia, PA		
1. Date: May 26, 2013			
2. Facility Name Spray Products Corporation		3. EPA ID PAD042716084	
4. Your Name Susan R. Frund		5. Organization Michael Baker Jr., Inc.	
6. Total Acres 7.25			
Continued Use: Total acres <u>7.25</u>	Reused: Total acres _____	Planned Reuse: Total acres _____	Unused: Total acres _____
Types of Use <input type="checkbox"/> Agricultural <input type="checkbox"/> Commercial <input type="checkbox"/> Ecological <input checked="" type="checkbox"/> Industrial <input type="checkbox"/> Military <input type="checkbox"/> Other Federal <input type="checkbox"/> Public Services <input type="checkbox"/> Recreational <input type="checkbox"/> Residential <input type="checkbox"/> Mixed Use	Types of Use <input type="checkbox"/> Agricultural <input type="checkbox"/> Commercial <input type="checkbox"/> Ecological <input type="checkbox"/> Industrial <input type="checkbox"/> Military <input type="checkbox"/> Other Federal <input type="checkbox"/> Public Services <input type="checkbox"/> Recreational <input type="checkbox"/> Residential <input type="checkbox"/> Mixed Use	Types of Use <input type="checkbox"/> Agricultural <input type="checkbox"/> Commercial <input type="checkbox"/> Ecological <input type="checkbox"/> Industrial <input type="checkbox"/> Military <input type="checkbox"/> Other Federal <input type="checkbox"/> Public Services <input type="checkbox"/> Recreational <input type="checkbox"/> Residential <input type="checkbox"/> Mixed Use	

Unit Conversions: 1 square foot = 0.000023 acre; 1 square meter = 0.0002471 acre

Current Land Use

Continued Use - A site or portion of a site which is currently being used in the same general manner as it was when the site became contaminated. For example, continued use would be an appropriate description for a property where industrial operations resulted in the contamination and the property is still used as an operating industrial facility. The RCRA Program will count all acres of an active RCRA industrial facility as Continued Use, except for parcels specifically designated as Reused or Planned Reuse.

Reused - A site or portion of a site where a new use, or uses, is occurring such that there has been a change in the type of use (e.g. industrial to commercial) or the property was vacant and now supports a specific use. This means that the developed site, or portion of the site, is "open" or actually being used by customers, visitors, employees, residents, etc.

Planned Reuse - A site or portion of a site where a plan for new use is in place. This could include conceptual plans, a contract with a developer, secured financing, approval by the local government, or the initiation of site redevelopment.

Unused - A site or portion of a site that is currently vacant or not being used in any identifiable manner. This could be because site investigation and cleanup are on-going, operations ceased or owner is in bankruptcy, or cleanup is complete but the site remains vacant.

Types of Use

Commercial Use – Commercial use refers to use for retail shops, grocery stores, offices, restaurants and other businesses.

Public Service Use – Public service use refers use by a local or state government agency or a non-profit group to serve citizens' needs. This can include transportation services such as rail lines and bus depots, libraries and schools, government offices, public infrastructure such as roads, bridges, utilities or other services for the general public.

Agricultural Use – Agricultural uses refers to use for agricultural purposes, such as farmland for growing crops and pasture for livestock. It also can encompass other activities, such as orchards, agricultural research and development, and irrigating existing farmland.

Recreational Use – Recreational use refers to use for recreational activities, such as sports facilities, golf courses, ball fields, open space for hiking and picnicking, and other opportunities for indoor or outdoor leisure activities.

Ecological Use – Ecological use refers to areas where proactive measures, including a conservation easement, have been implemented to create, restore, protect or enhance a habitat for terrestrial and/or aquatic plants and animals, such as wildlife sanctuaries, nature preserves, meadows, and wetlands.

Industrial Use – Industrial use refers to traditional light and heavy industrial uses, such as processing and manufacturing products from raw materials, as well as fabrication, assembly, treatment, and packaging of finished products. Examples of industrial uses include factories, power plants, warehouses, waste disposal sites, landfill operations, and salvage yards.

Military Use – Military use refers to use for training, operations, research and development, weapons testing, range activities, logistical support, and/or provision of services to support military or national security purposes.

Other Federal Use – Other federal use refers to use to support the Federal government in federal agency operations, training, research, and/or provision of services for purposes other than national security or military.

Mixed Use – Mixed use refers to areas at which uses cannot be differentiated on the basis of acres. For example, a condominium with retail shops on the ground floor and residential use on the upper floors would fall into this category.

Residential Use – Residential use refers to use for residential purposes, including single-family homes, town homes, apartment complexes and condominiums, and child/elder care facilities.